

FINAL REPORT

NASA Grant NGr 22-004-024

This project was to explore the possibility of following the movements of a bird from an artificial earth satellite. Certain birds move such great distances over difficult surroundings that the details of their wanderings are unknown, and no other method could be practical. It was also felt that if a small enough and light enough transmitter could be developed to allow the bird to fly, then similar equipment could be used with any other sort of animal (or inanimate platform) for other satellite or long range non-satellite studies.

Suitable subjects would have to be big birds that travel distances large compared to the resolving power of the satellite system. The greater albatrosses are of biological interest and qualify. Electrical interference in this domain should be limited.

A harness was developed that would hold the transmitter and yet allow the subject relatively normal activity. Arrangements were studied that would allow automatic detachment of the harness when the power source became depleted.

No particular satellite system was considered at the start of the project, though a particular one with specified parameters (including power and frequency) is now being readied by NASA. Thus general consideration was given to Doppler systems and ideal conditions for the present purpose. It appeared that the experiment would be possible.

Small low power crystal oscillators were studied and an adequately stable one developed. Output stages were considered. Antennas were investigated from both the engineering and biological viewpoints. A reasonable system was described.

Consideration was also given to incorporating some biological information into the tracking signal. Simple parameters such as temperature or altitude or wing motions are of interest, and some progress was made on development of a cardiac output measuring system.

Effort was made to make the results of this work generally available. Various aspects are covered in the following publications by R. Stuart Mackay:

N74-19794
 (NASA-CR-137369) [EXPLORING THE
 POSSIBILITY OF FOLLOWING THE MOVEMENTS OF
 A BIRD FROM AN ARTIFICIAL EARTH
 SATELLITE] Final Report (Boston Univ.)
 CSCL 17B G3/07
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Bio-Medical Telemetry, Second Edition, John Wiley, Inc. New York (1970).

Sensing and transmitting biological information from animals and man.

The Keynote Address in Biotelemetry, pp 21-38, published by CSIRO, Pretoria, 1971.

Bio-telemetry, fetuses, bird harnesses, and satellites. Opening lecture at the 9th International Conference on Medical and Biological Engineering, Melbourne 1971 Digest pages 11-13.

Telemetry in animal and human biometeorology. In Biometeorology Vol. 5, Part II (Edited by S. Tromp, W. Weihe, and V. Bouma) pp 171-185, published by Swets and Zeitlinger, Amsterdam (1972).

Non-invasive cardiac output measurement. Microvascular Research 4, pp 438-452 (1972).

Measuring and telemetering heart stroke volume. In Digest of X International Conference on Medical and Biological Engineering, pg 18, Dresden 1973.

Continuous monitoring of cardiac output (with H. Hechtman). Biotelemetry Vol 1 No 1, Jan. 1974 (new journal on biotelemetry and patient monitoring).

Some of the most direct information is to be found in the Pretoria or in the somewhat similar Biometeorology publications. Various aspects of the developments will be further discussed in subsequent lectures and publications.

R. Stuart Mackay
February, 1974